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The maximum pulse repetition rate and average power of liquid crystal (LC) lasers are limited due to effects such as dye-bleaching and director reorientation [1] that reduce the laser efficiency. These performance limitations mean that LC lasers devices are currently unsuitable for many applications. This study demonstrated a method of enabling LC lasers to be operated higher repetition rates and average powers by spinning the LC laser cell at a high frequency, with the aim of creating a more versatile laser system with improved performance.

A prototype spinning system was evaluated with a dye-doped chiral nematic LC laser. An improvement in the maximum average power was demonstrated through monitoring the energy of the laser pulses. It was found that pump frequencies greater than 3 kHz could be used with only a slight reduction in the laser efficiency; this represents an order of magnitude increase over a static cell. As expected, spinning the cell increased the stability of the emission power [2], but also resulted in a small variation in the wavelength of the laser line due to the excitation of different chiral domains.

A summary of the key performance parameters of the spinning LC laser system will be presented and its limitations discussed. Possible application areas for such a system include microscopy and high throughput sensing.

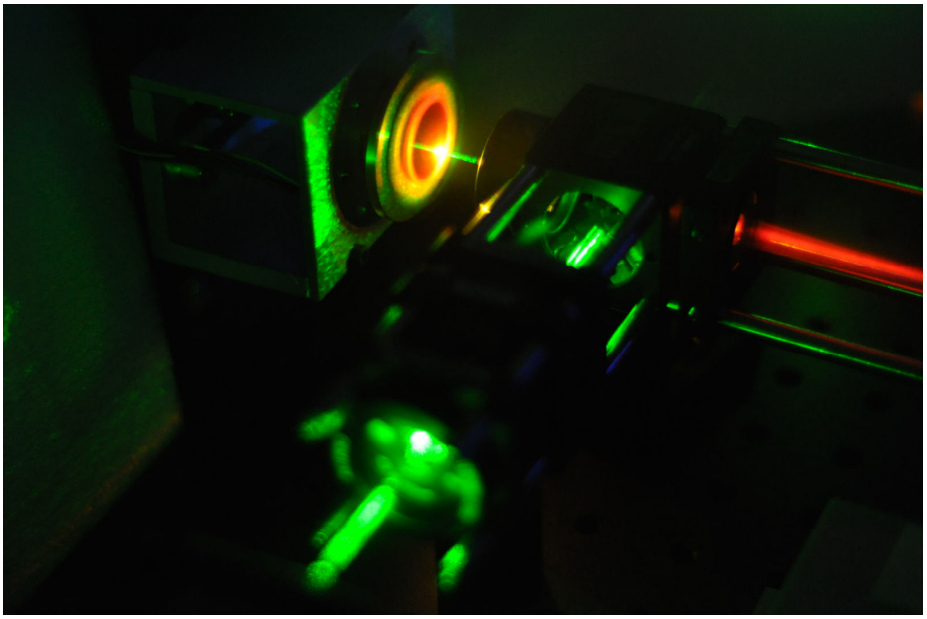

Figure 1. The spinning liquid crystal laser system in use with a green pump laser. The emission from the LC laser can be seen in red.

References

[1] Morris, S M, Ford, A D, et. al, J. Opt. A: Pure Appl. Opt. 7, 215–223 (2005)
[2] Chilaya G, Chanishvili A, et. al, Opt. Express 14, 9939-9943 (2006)